



Albuquerque Bernalillo County Water Utility Authority

Voluntary Occurrence Monitoring for Pharmaceuticals & Personal Care Products

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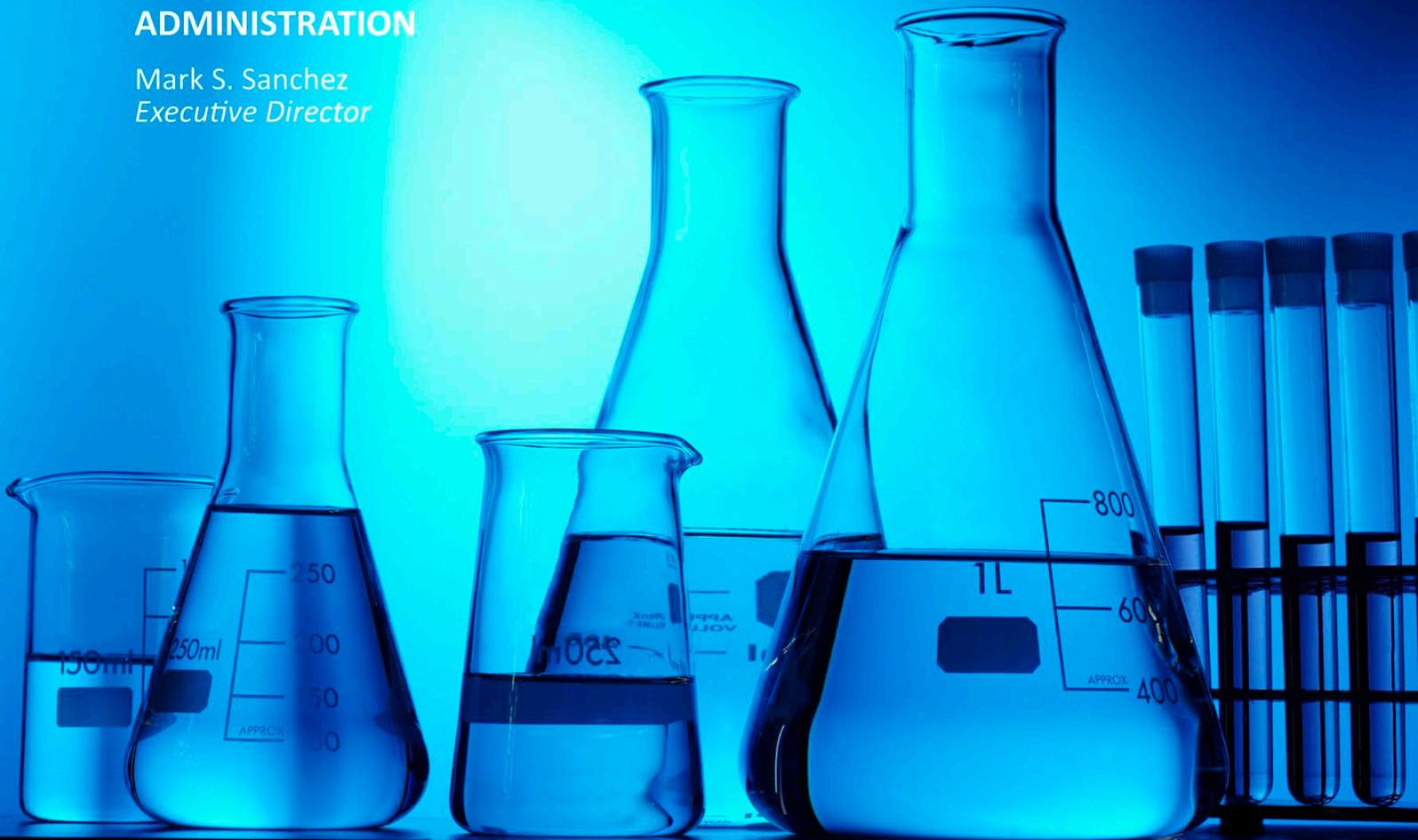
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March 2011

VOLUNTARY OCCURRENCE MONITORING FOR PHARMACEUTICALS AND PERSONAL CARE PRODUCTS

September 2009 – June 2010

Albuquerque Bernalillo County Water Utility Authority

Executive Summary

In December 2008, the Albuquerque Bernalillo County Water Utility Authority (Water Authority) began adding surface water to the municipal drinking water supply through the San Juan-Chama Drinking Water Project (DWP). Reports by the Associated Press in 2008 highlighted the possible presence of pharmaceuticals and personal care products (PPCPs) in surface water. Although there are no known human health effects from PPCPs at the extremely low concentrations in question, the Water Authority undertook a voluntary testing program for PPCPs to gauge the occurrence of these substances and to establish baseline data should regulations for PPCPs be put in place at some point in the future.

Results showed a low occurrence of PPCPs in the water system (pre- and post-treatment) and a much higher occurrence in the wastewater system. Of the more than one hundred substances tested, 81% were never detected in the finished drinking water (Figure a). Of the five hundred analytical tests on the finished drinking water, PPCPs were detected in only 8% of the tests (Figure b). Concentrations of detected PPCPs in the finished drinking water ranged between 0.167 and 4060 nanograms per liter (ng/L) with an average concentration of the detected results of 177 ng/L.

Cholesterol was one of the PPCPs detected in the finished drinking water. The highest concentration of Cholesterol was 4060 ng/L. To put that level in perspective, on average, an egg contains 200 milligrams of Cholesterol. Drinking two (2) liters of finished drinking water per day at a concentration of 4060 ng/L Cholesterol, it would take a person more than 67 years to ingest the amount in an egg (200 milligrams).

Figure a. Frequency of Occurrence of 113 PPCPs in Finished Drinking Water

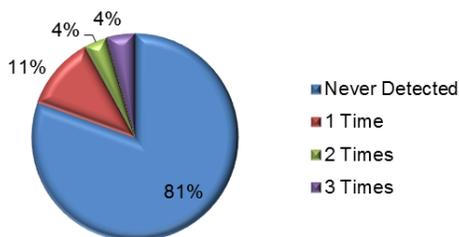
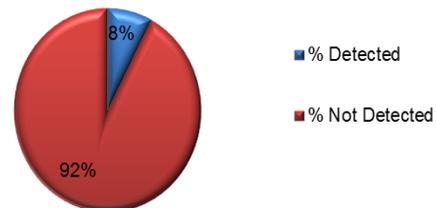


Figure b. Percent of Detections (After Blank Correction) vs. Total Analyses in Finished Drinking Water



Introduction

In December 2008, the Albuquerque Bernalillo County Water Utility Authority (Water Authority) implemented the San Juan-Chama Drinking Water Project (DWP), which began adding purified surface water to the municipal drinking water supply.

The purpose of the DWP is to eliminate sole reliance on the overtaxed regional aquifer and transition to a renewable and sustainable surface water supply. The DWP is the most important component of the Water Authority's Water Resources Management Strategy (Strategy) which also includes water conservation and water reuse. Under the Strategy, the aquifer is to be preserved as a long-term drought reserve and otherwise used only to meet peak demand. In just two (2) years of DWP operation, the U.S. Geological Survey has reported that ground water levels are rising in the Albuquerque Basin.

Reports by the Associated Press during 2008 highlighted the possible presence of pharmaceuticals and personal care products (PPCPs) in surface water. The Water Authority undertook a voluntary testing program for PPCPs to gauge the occurrence of these substances at various points in the water and wastewater system and to establish baseline data should regulations for PPCPs be put in place at some point in the future. The results of the first year of occurrence monitoring are provided in this report.

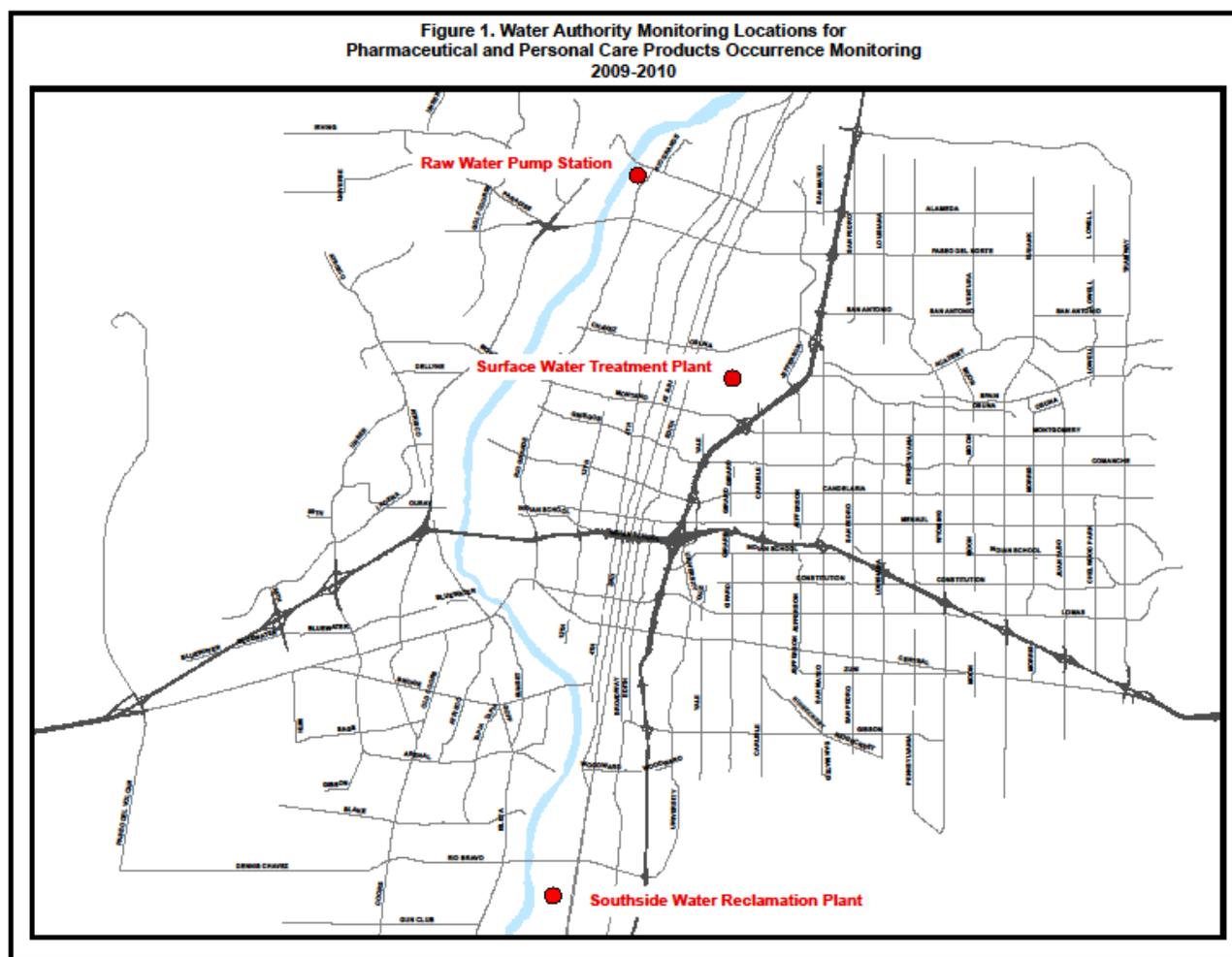
At the present time, according to the U.S. Environmental Protection Agency (EPA), scientists have found no evidence of adverse human health effects from PPCPs in the environment. The risks are unknown, largely because the concentrations are so low. There are no known human health effects from such low-level exposures in drinking water. More investigation is needed (<http://www.epa.gov/ppcp/>).

There are thousands of PPCPs. The Water Authority's monitoring program focused on a subset of 113 substances included in two EPA analytical methods. None are regulated under the federal Safe Drinking Water Act (SDWA) or the Clean Water Act (CWA). However, the EPA, which administers enforcement of both the SDWA and the CWA, is reviewing nine (9) of those substances as part of its Contaminant Candidate List 3 (CCL3) efforts (<http://water.epa.gov/scitech/drinkingwater/dws/ccl/ccl3.cfm>) for possible future regulation.

The Water Authority voluntarily monitored for PPCPs in both the drinking water and wastewater systems. Specifically, the Water Authority collected 24-hour composite samples from five (5) locations in September 2009, December 2009, March 2010 and June 2010. The monitoring locations and identifications are listed in Table 1 and generally identified in Figure 1 on the following page.

Overall, results of the effort showed an extremely low occurrence of PPCPs in source water prior to treatment and an even lower occurrence post-treatment. Predictably, contributions of PPCPs by users of the wastewater collection system resulted in a much higher incidence of PPCPs at the intake to the wastewater treatment plant.

Table 1. Monitoring Location, Identification and Purpose		
Monitoring Location	Monitoring Identification	Monitoring Purpose
Source Water – San Juan-Chama water	Raw Water Pump Station (RWPS)	Untreated surface water/background concentrations
Treated water after ozonation process at surface water treatment facility	Filter Influent (FI)	Effect of water treatment processes through ozonation process (pre-filtration)
Finished Water from the finished water pump station (finished water)	Water Treatment Plant Entry Point (WTPEP01)	Effect of water treatment processes (post-filtration)
Influent to the Southside Water Reclamation Plant (SWRP) (influent)	SWRP Influent (TP2.3)	Contributions from Albuquerque Bernalillo County Water Utility Authority customers
Effluent from SWRP (discharged to Rio Grande) (effluent)	SWRP Effluent (TP2.7)	Effect of SWRP treatment processes



What are PPCPs and where do they come from?

The EPA defines PPCPs in general as "...any product used by individuals for personal health or cosmetic reasons or used by agribusiness to enhance growth or health of livestock." They also are comprised of natural and man-made endocrine-disrupting chemicals. PPCPs comprise a diverse collection of thousands of chemical substances including:

- Prescription and over-the-counter therapeutic drugs
- Veterinary drugs
- Fragrances
- Lotions
- Cosmetics

People contribute PPCPs when:

- Medication residues are excreted from their bodies as waste and flushed into sewer lines,
- Externally applied drugs and personal care products are washed down the shower drain, and
- Unused or expired medications are flushed down the toilet.

Monitoring Plan and Analytical Methods

In Fiscal Year 2010, the Water Authority conducted a one-year monitoring program for PPCPs to determine the levels that potentially occur in source water and finished water from the new surface water treatment plant, as well as in the influent and effluent from the Southside Water Reclamation Plant (SWRP). Other objectives included estimating treatment removal efficiencies and contributions from the Albuquerque metropolitan area.

A part per trillion is equivalent to:

*three seconds out of every
100,000 years
or
one drop of water diluted in 20
Olympic sized swimming pools
(13,200,000 Gallons total)*

Analytical methods for a wide variety of PPCPs at low detection levels are available only for research purposes and by a limited number of laboratories. The Water Authority chose two analytical methods that measure more than 100 PPCPs at very low levels (nanograms per liter (ng/L) or part per trillion (ppt)). For all but a few exceptions, results for organic analyses obtained through commonly available analytical methods are reported typically in the microgram per liter (part per billion (ppb)) level. The analytical methods used for this occurrence monitoring provided results 1000 times more sensitive. The analytical cost for each sample varied between \$2000 and \$3500 depending on the contract laboratory.

Samples were collected following an approved protocol and sampling techniques using automated composite sampling equipment. A total of 10 liters of sample was collected on a time weighted basis for four (4) of the locations (raw water pump station, after ozone, finished water and SWRP influent). The composite for the fifth location (SWRP effluent) was flow weighted.

Sample bottles provided by the contract laboratories were filled with the composited samples, labeled, placed on ice, delivered to the contract laboratory and then shipped to the subcontract laboratory. Samples were analyzed by AXYS Analytical Services (located in British Columbia, Canada) using:

- AXYS Method MLA-075. (high performance liquid chromatography combined with tandem mass spectrometry(HPLC/MS/MS))¹ and
- AXYS Method MLA-068. (isotope dilution and internal standard high resolution gas chromatography combined with high resolution mass spectrometry (HRGC/HRMS))².

The subcontract laboratory provided results for 113 substances; 86 substances for AXYS Method MLA-075 and 27 substances based on AXYS Method MLA-068. The list of substances is provided in Table 2.

Table 2. Pharmaceuticals and Personal Care Products (PPCPs) Substances			
AXYS Method MLA-075 (EPA Method 1694)			AXYS Method MLA-068 (EPA Method 1698)
1,7-Dimethylxanthine (p-Xanthine)	Dehydronifedipine	Ormetoprim	17a-Dihydroequilin
2-hydroxy-ibuprofen	Demeclocycline	Oxacillin	17alpha-Estradiol*
4-Epianhydrotetracycline (EATC)	Digoxigenin	Oxolinic acid	17alpha-Ethinyl estradiol*
4-Epianhydrochlortetracycline (EACTC)	Digoxin	Oxycodone	17beta-Estradiol*
4-Epichlorotetracycline (ECTC)	Diltiazem	Oxytetracycline	Androstenedione
4-Epioxytetracycline (EOTC)	Diphenhydramine	Penicillin G	Androsterone
4-Epitetracycline (ETC)	Doxycycline	Penicillin V	B-Estradiol-3-benzoate
Acetaminophen	Enalapril	Ranitidine	beta-Sitosterol
Albuterol (Salbutamol)	Enrofloxacin	Roxithromycin	beta-Stigmastanol
Amphetamine	Erythromycin anhydrate	Sarafloxacin	Campesterol
Anhydrochlortetracycline (ACTC)	Flumequine	Sulfachloropyridazine	Cholestanol
Anhydrotetracycline (ATC)	Fluoxetine (Prozac)	Sulfadiazine	Cholesterol
Atenolol	Furosemide	Sulfadimethoxine	Coprostanol
Atorvastatin	Gemfibrozil	Sulfamerazine	Desmosterol
Azithromycin	Glipizide	Sulfamethazine	Desogestrel
Bisphenol A	Glyburide	Sulfamethizole	Epicoprostanol
Caffeine	Hydrochlorothiazide	Sulfamethoxazole	Equilenin*
Carbadox	Hydrocodone	Sulfanilamide	Equilin*
Carbamazepine	Ibuprofen	Sulfathiazole	Ergosterol
Cefotaxime	Isochlortetracycline (ICTC)	Tetracycline (TC)	Estriol*
Chlortetracycline	Lincomycin	Thiabendazole	Estrone*
Cimetidine	Lomefloxacin	Triamterene	Mestranol*
Ciprofloxacin	Metformin	Triclocarbon	Norethindrone*
Clarithromycin	Miconazole	Triclosan	Norgestrel
Clinafloxacin	Minocycline	Trimethoprim	Progesterone
Clonidine	Naproxen	Tylosin	Stigmasterol
Cloxacillin	Norfloxacin	Virginiamycin	Testosterone
Codeine	Norgestimate	Warfarin	
Cotinine	Ofloxacin		

* These substances are included in EPA's Contaminant Candidate List 3 published October 8, 2009.

¹ This is the performance based implementation of EPA Method 1694 Pharmaceuticals and Personal Care Products in Water, Soil, Sediment, and Biosolids by HPLC/MS/MS, December 2007.

http://water.epa.gov/scitech/swguidance/methods/bioindicators/upload/2008_01_03_methods_method_1694.pdf

² This is the performance based implementation of EPA Method 1698 Steroids and Hormones in Water, Soil, Sediment, and Biosolids by HRGC/HRMS, December 2007 for Hormones and Steroids.

http://water.epa.gov/scitech/swguidance/methods/bioindicators/upload/2008_01_03_methods_method_1698.pdf

Monitoring and Occurrence Results

This report includes summaries of the analytical results. The laboratory conducted analyses capable of detection at extremely low levels, reporting results in nanograms per liter (ng/L) or parts per trillion (ppt). The analytical methods are typically 1000 times more sensitive than those used for the organic substances regulated by EPA.

To determine if substances or interferences are present in the laboratory environment, laboratory blanks are analyzed along with the samples. When the laboratory detected a substance in both the sample and in the associated laboratory blank, the Water Authority “blank corrected”³ the results. If the resulting difference was less than the detection level⁴ associated with the sample, the result is reported as undetected. Results were blank corrected only for AXYS Method MLA-068 results. No substances were detected in the laboratory blanks for AXYS Method MLA-075, thus blank correction was not necessary. Detection levels vary by substance and also monitoring location due to different interferences in a sample matrix. Summaries of blank corrected results and detection levels for substances detected by method, location and quarter are included in the Appendix to this report.

Some PPCPs were detected in all sites. For the raw water pump station, filter influent and finished water, the number of occurrences and concentrations were generally very low (16%, 7% and 8% of the total analyzed, respectively). As expected, the number of detected PPCPs for the wastewater plant was significantly higher, 53% of the total analyzed in SWRP influent and 38% of the total analyzed in SWRP effluent. Table 3 provides a summary of the number of substances detected by location and quarter.

Table 3. Number of Substances Detected after Blank Correction						
Location	Date	Pharmaceuticals (86 Substances)	Steroids and Hormones (27 Substances)	Total # Detected	Percent Detected	Average Percent Detected
Raw Water Pump Station (RWPS)	Sep-09	8	9	17	15%	16%
	Dec-09	12	9	21	19%	
	Mar-10	12	8	20	18%	
	Jun-10	6	8	14	12%	
Filter Influent (FI)	Sep-09	2	3	5	4%	7%
	Dec-09	5	6	11	10%	
	Mar-10	3	3	6	5%	
	Jun-10	6	5	11	10%	
Finished Water (WTPEP01)	Sep-09	0	13	13	12%	8%
	Dec-09	1	8	9	8%	
	Mar-10	6	5	11	10%	
	Jun-10	1	2	3	3%	
SWRP Influent (TP2.3)	Sep-09	44	21	65	58%	53%
	Dec-09	46	15	61	54%	
	Mar-10	47	11	58	51%	
	Jun-10	42	15	57	50%	
SWRP Effluent (TP2.7)	Sep-09	35	11	46	41%	39%
	Dec-09	34	13	47	42%	
	Mar-10	34	8	42	37%	
	Jun-10	34	6	40	35%	

³ Blank correction: subtracting the concentration detected in the laboratory blank from the concentration detected in the sample.

⁴ Detection Level: the smallest amount of a substance that can be detected to a known level of certainty.

The frequency of occurrence for the 113 substances at the five (5) monitoring locations is charted in Figures 2a through 2e. With four (4) quarterly samples, the frequency of occurrence for a substance would range between zero to four (4) times. For example, in the raw water pump station (Figure 2a), the majority of substances (83 out of 113) were not detected in any of the four (4) quarters of monitoring. Of the substances that were detected in the raw water pump station, 10 of them were detected only once, seven (7) were detected twice, four (4) were detected three (3) times and nine (9) were detected four (4) times.

Figures 3a and 3b show the fluctuation in concentrations for six (6) selected substances at the five (5) monitoring locations over the monitoring period. Campesterol, Stigmasterol, Sulfamethoxazole and Testosterone are charted in Figure 3a and Beta-sitosterol and Cholesterol in Figure 3b. These are six (6) of the PPCPs with the highest concentrations detected in the finished water over the entire monitoring program.

The trends indicate: low levels in the source water (raw water pump station), lower concentrations or no detection at the water treatment plant process locations (filter influent and finished water), significant increases in the SWRP influent and lower concentrations in the SWRP effluent. With the exception of the concentrations of Beta-sitosterol and Stigmasterol in the SWRP effluent in March 2010, the highest concentrations of these PPCPs are found in the SWRP influent, indicative of the contributions from the Albuquerque metropolitan area. The figures show the results in ng/L.

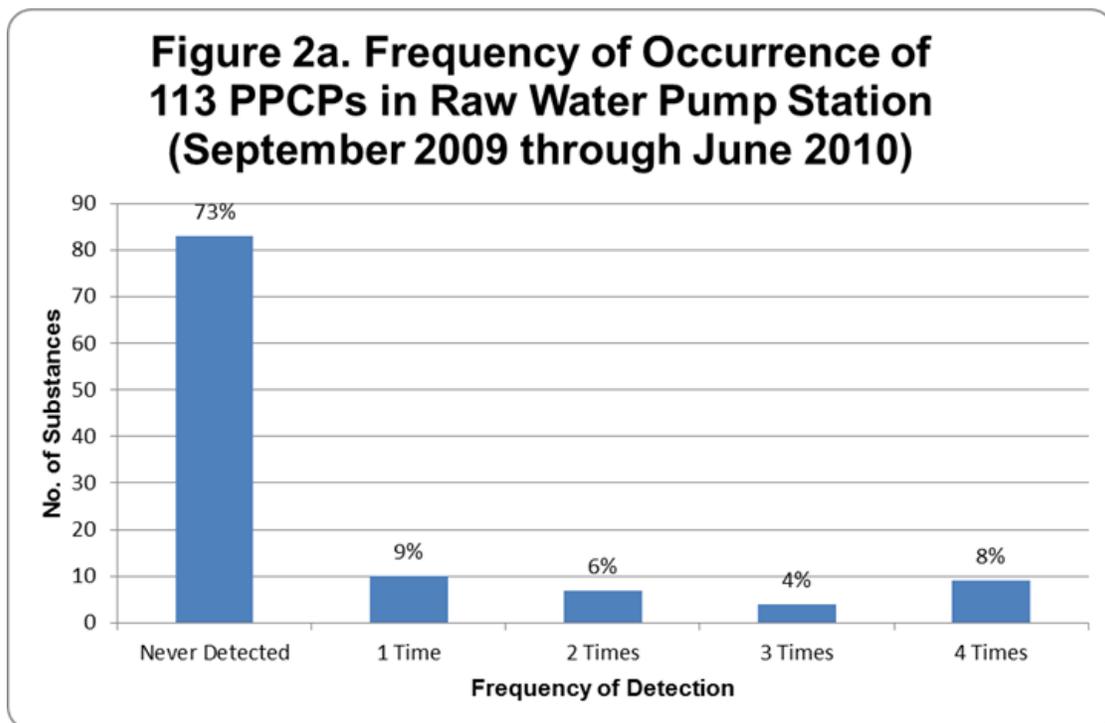


Figure 2b. Frequency of Occurrence of 113 PPCPs in Filter Influent (September 2009 through June 2010)

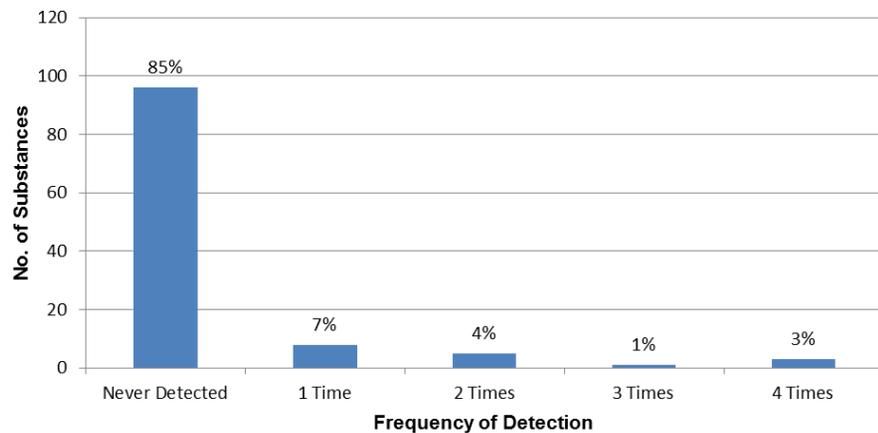


Figure 2c. Frequency of Occurrence of 113 PPCPs in Finished Water (September 2009 through June 2010)

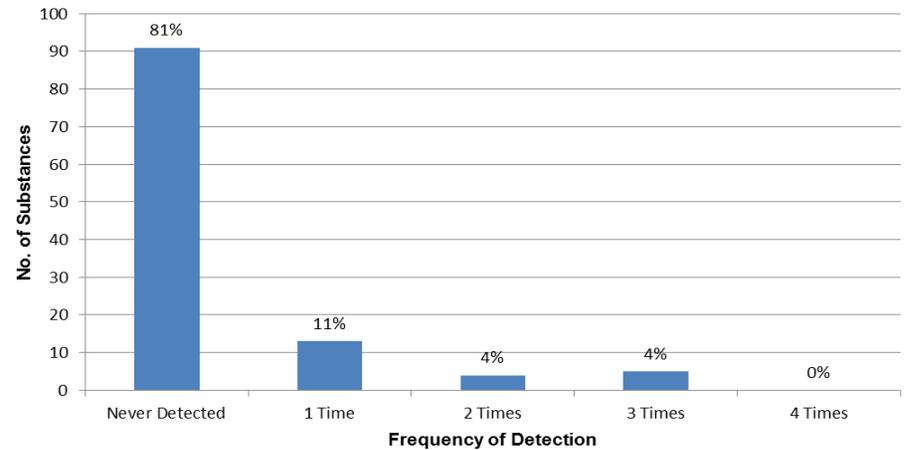


Figure 2d. Frequency of Occurrence of 113 PPCPs in SWRP Influent (September 2009 through June 2010)

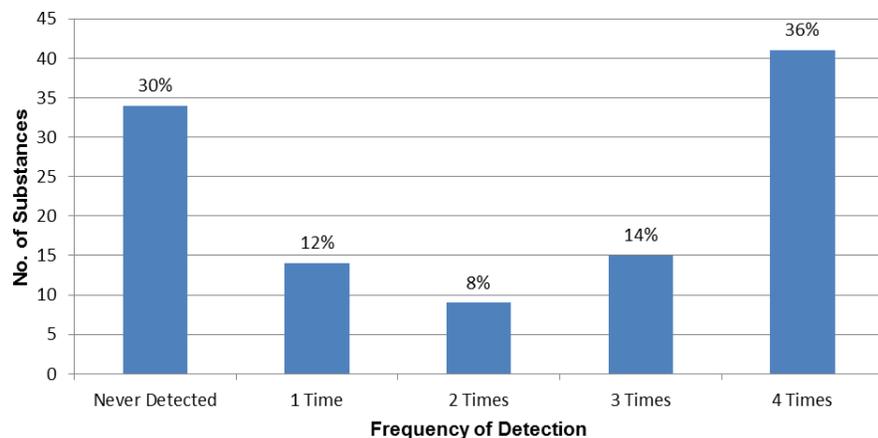


Figure 2e. Frequency of Occurrence of 113 PPCPs in SWRP Effluent (September 2009 through June 2010)

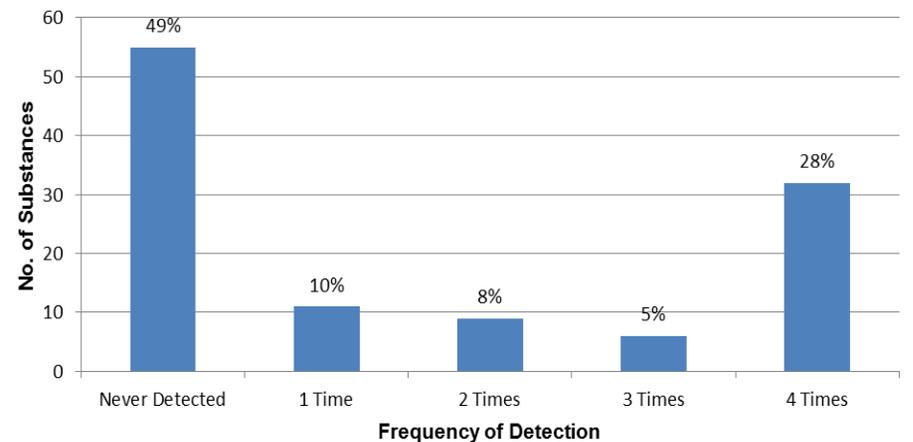


Figure 3a. Comparison of Select Substance Detections at Monitoring Locations for PPCPs

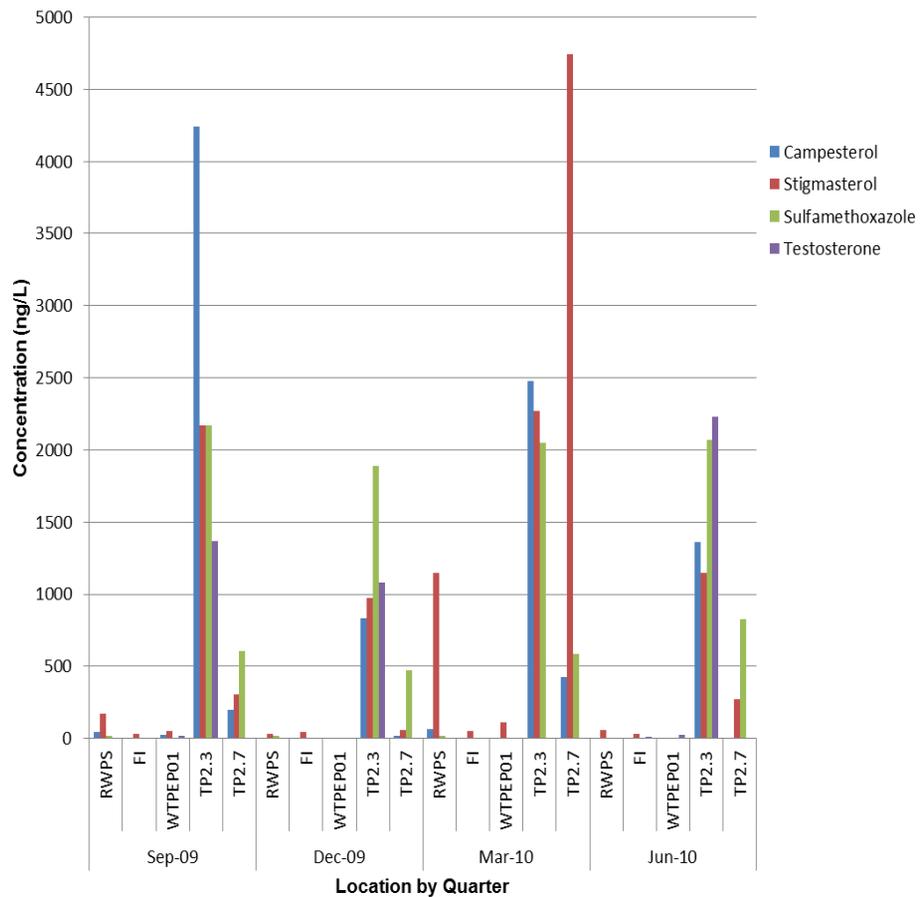
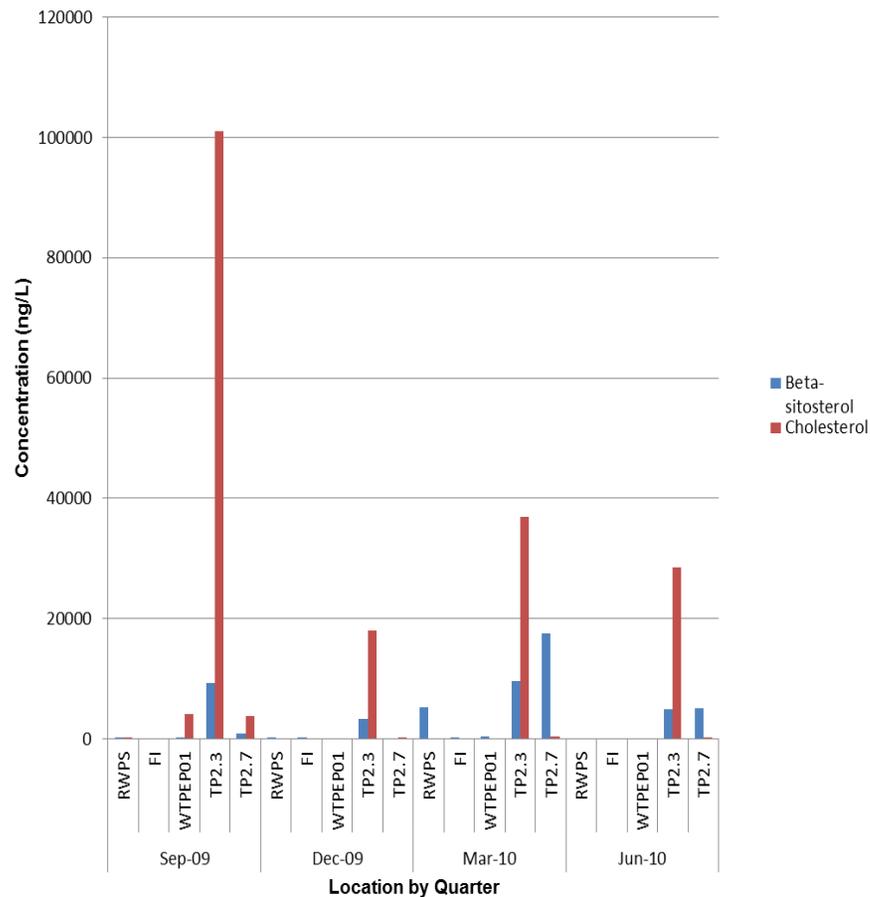


Figure 3b. Comparison of Select Substance Detections at Monitoring Locations for PPCPs



Conclusions

The vast majority of monitored PPCPs were not detected at the raw water pump station (where source water from the river is pumped to the surface water treatment plant) or the finished water following treatment at the surface water treatment plant. Although some PPCPs were detected in the finished water, the levels were very low and often close to the detection level specified for the substance and location.

To provide a perspective, for several of the substances detected in the finished water, the Water Authority compared the greatest concentration detected for that substance to a commonly prescribed or recommended dose (Table 4a). A similar comparison was prepared for substances detected in the SWRP effluent (Table 4b).

HOW small IS A NANOGRAM?

One (1) gram is equivalent to a packet of sugar

One thousandth of a gram is a milligram (10^{-3} grams)

One thousandth of a milligram is a microgram (10^{-6} grams)

One thousandth of a microgram is a nanogram (10^{-9} grams)

For example, Ibuprofen was detected in the finished water in March 2010 at a concentration of 50.8 ng/L. A common dose for Ibuprofen is 200 milligrams (mg). First, one must convert the concentration detected into mg/L and then divide the dose by that amount to calculate the number of liters it would take to match the dose.

$$\frac{50.8ng}{L} \times \frac{mg}{1,000,000ng} = \frac{0.0000508mg}{L}$$
$$200mg \times \frac{1L}{0.0000508mg} \cong 3,940,000L$$

In other words, a person would have to drink approximately 3,940,000 liters (1,041,000 gallons) of finished drinking water to ingest a 200 mg dose of Ibuprofen. This means that if one consumed two-liters of finished water per day, it would take more than 5,000 years to ingest a single dose of Ibuprofen.

The concentration of detected PPCPs in the source water at the raw water pump station is very low. In contrast, the concentration of detected PPCPs detected in the SWRP influent is significantly higher, owing to contributions to the wastewater system by the local population.

The water and wastewater treatment plant processes are very good at removing the PPCPs. This is consistent with the current understanding of treatment plant performance as discussed in American Water Works Association (AWWA) Research Foundation Report 91188 (Removal of EDCs and Pharmaceuticals in Drinking and Reuse Treatment Processes, AWWA).

Next Steps

The monitoring that was performed along with the substances that were detected and those undetected are presented in this report. This report is considered to be a living document with data and information provided to Water Authority customers as a means of communicating knowledge of the occurrence of PPCPs in the water and wastewater.

The Water Authority will continue this monitoring program in 2011 and will publish the data on an annual basis on the Water Authority website (www.abcwua.org). In addition, the Water Authority will continue to review PPCP health effects research. Future steps will be identified as additional information on both occurrence and health effects become available.

Table 4a. Comparison of Substance Concentration in Finished Water to Commonly Prescribed Dose or Dietary Amount

Substance	Classification	Level Detected (ng/L)	Commonly Prescribed Dose or Dietary Amount	Volume of Water Needed to Consume to Meet Prescribed Dose or Dietary Amount		Years of Consumption at Two (2) Liters to Meet Prescribed Dose
				Liters	Gallons	
Ibuprofen	Analgesic	50.8	200 mg	3,940,000	1,041,000	5,390
Testosterone	Sex hormone	23.3	200 mg	8,580,000	2,270,000	11,800
Campesterol	Plant sterol	23.9	33.7 mg/Tbsp Vegetable Oil	1,410,000	372,000	1,930
Stigmasterol	Plant sterol	114	0.4 mg/Tbsp Vegetable Oil	3,510	927	5
Naproxen	Non-steroidal anti-inflammatory drug	210	250 mg	1,190,000	314,000	1,630
2-Hydroxy-Ibuprofen	Metabolite of Ibuprofen	545	200 mg	367,000	97,000	503
Beta-Sitosterol	Plant sterol	462	57.8 mg/Tbsp Vegetable Oil	125,000	33,000	171
Cholesterol	Sterol	4060	200 mg	49,300	13,000	67

Table 4b. Comparison of Substance Concentration in SWRP Effluent to Commonly Prescribed Dose or Dietary Amount

Substance	Classification	Level Detected (ng/L)	Commonly Prescribed Dose or Dietary Amount	Volume of Effluent Equal to Prescribed Dose or Dietary Amount	
				Liters	Gallons
Caffeine	Stimulant	323	150 mg/cup (1 cup/day)	464,000	123,000
Hydrochlorothiazide	Blood pressure medication	927	25 mg	27,000	7,120
Azithromycin	Macrolide antibiotic	1030	250 mg	243,000	64,100
2-Hydroxy-Ibuprofen	Metabolite of Ibuprofen	1190	200 mg	168,000	44,400
Atenolol	Blood pressure medication	1310	25 mg	19,100	5,040
Cholesterol	Sterol	3850	200 mg	51,900	13,700
Stigmasterol	Plant sterol	4740	0.4 mg/Tbsp Vegetable Oil	84	22
Metformin	Anti-diabetic drug	10300	500 mg	48,500	12,800
Beta-Sitosterol	Plant sterol	17600	57.8 mg/Tbsp Vegetable Oil	3,280	868

APPENDIX

Blank Corrected Results for PPCPs Detected at WTP and SWRP Monitoring Locations (Tables 5a through 5d)

Table 5a: Blank Corrected Results for AXYS Method MLA-075 (EPA Method 1694) Detected Substances at WTP Monitoring Locations (ng/L)

Substance	RWPS								FI								WTPEP01								Classification
	Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL											
2-hydroxy-ibuprofen	U	83.7	U	88.3	U	86.7	U	88.2	U	99.9	363	88.4	224 (N)	81.6	336	104	U	76.7	414	367	545 (N)	250	128	88.2	Anti-inflammatory
Albuterol	U	0.32	1.01	0.324	U	0.3	U	0.3	U	0.340	U	0.323	U	0.300	U	0.304	U	0.292	U	0.32	U	0.299	U	0.3	Antiasthmatic
Amphetamine	1.68	1.6	U	1.61	U	4.11	U	1.5	U	1.70	2.14	1.61	U	1.5	1.56	1.52	U	1.46	U	1.6	1.8	1.52	U	1.5	Stimulant
Atenolol	1.71	0.639	4.78	0.645	2.84	0.6	0.731	0.599	U	0.680	1.08	0.645	0.819	0.600	U	0.609	U	0.585	U	0.641	U	0.599	U	0.682	Antihypertensive
Bisphenol A	U	2620	U	2760	U	2710	U	551	U	3120	U	2760	U	2550	11400	650	U	2400	U	11500	U	7800	U	547	Used to make plastics
Caffeine	U	15.7	U	16.6	U	16.2	U	16.5	19.5	18.7	194	16.6	U	15.3	U	19.5	U	14.4	U	68.8	U	15.6	U	16.4	Stimulant
Carbamazepine	5.85	1.57	8.18	1.66	6.62	1.62	U	1.65	U	1.87	U	1.66	U	1.53	U	1.95	U	1.44	U	6.88	U	1.56	U	1.64	Anticonvulsant
Cimetidine	U	0.32	1.08	0.489	1.11	0.6	U	0.599	U	0.340	U	0.323	U	0.600	U	0.609	NQ	NQ	U	0.326	NQ	NQ	U	0.682	Anti-acid reflux
Cotinine	5.99	1.6	2.61	1.61	9.98	1.5	3.75	1.5	4.78	1.7	2.84	1.61	5.86	1.50	1.55	1.52	U	1.46	U	1.6	27.2	1.5	U	1.7	Nicotine metabolite
Diltiazem	U	0.314	0.833	0.331	0.677	0.325	U	0.331	U	0.375	U	0.332	U	0.306	U	0.390	U	0.288	U	1.38	U	0.312	U	0.328	Antihypertensive
Diphenhydramine	U	0.628	U	0.663	U	0.65	U	0.661	U	0.749	U	0.663	U	0.612	1.65	0.781	U	0.684	U	2.75	U	0.624	U	0.657	Antihistamine
Erythromycin anhydrate	0.38	0.314	1.88	0.331	2.08	0.325	0.641	0.331	U	0.375	U	0.332	U	0.306	U	0.390	U	0.288	U	1.38	U	0.312	U	0.328	Macrolide antibiotic
Furosemide	148	74.6	U	67.8	U	43.3	U	45.7	U	49.9	U	57.7	U	61.1	U	64.5	U	67.7	U	183	U	125	NQ	NQ	Diuretic
Gemfibrozil	U	1.57	1.97	1.66	14.5	1.62	U	1.65	U	1.87	U	1.66	U	1.53	U	1.95	U	1.44	U	6.87	13.7	4.68	U	1.64	Antilipemic
Ibuprofen	U	15.7	U	16.6	U	16.2	U	16.5	U	18.7	U	16.6	U	15.3	U	19.5	U	14.4	U	68.7	50.8	46.8	U	16.4	Analgesic
Metformin	NQ	NQ	U	32.3	U	30	52	8.64	U	110	U	32.3	U	30.0	33.2	10.1	U	104	U	32	U	29.9	U	11.7	Anti-diabetic drug
Naproxen	U	3.14	5.04	3.31	U	3.25	U	3.31	U	3.75	U	3.33	U	3.06	U	3.9	U	2.88	U	13.7	210	9.36	NQ	NQ	Non-steroidal anti-inflammatory drug
Oxycodone	0.997	0.639	U	0.882	2.68	0.6	U	1.61	U	0.680	U	1.33	U	0.600	U	0.609	U	0.585	U	0.988	U	0.599	U	0.682	Narcotic pain reliever
Ranitidine	U	0.709	1.92	0.829	1.44	0.6	U	0.599	U	0.704	U	0.803	U	0.600	U	0.609	U	0.664	U	0.701	U	0.599	U	0.682	Anti-acid reflux
Sulfamethoxazole	14.7	0.937	20.2	0.663	17.3	0.65	4.98	2.01	U	0.749	U	0.663	U	0.612	U	0.781	U	0.575	U	2.75	U	0.624	U	1.86	Sulfonamide antibiotic
Triamterene	U	0.32	3.1	0.323	2.85	0.3	1.29	0.38	U	0.340	U	0.323	U	0.300	U	0.304	U	0.292	U	0.32	U	0.299	U	0.341	Diuretic
Trimethoprim	U	1.57	U	1.66	2.97	1.62	U	1.65	U	1.87	U	1.66	U	1.53	U	1.95	U	1.44	U	6.88	U	1.56	U	1.64	Pyrimidine antibiotic

DL = Detection Level

K = Peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration

N = Percent Recovery was slightly above nominal method upper control limit

NQ = Not Quantifiable

U = Not Detected

Table 5b: Blank Corrected Results for AXYS Method MLA-068 (EPA Method 1698) Detected Substances at WTP Monitoring Locations (ng/L)

Substance	RWPS								FI								WTPEP01								WTPEP01 Dup01*		WTPEP01 Dup02*		Classification
	Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		Dec-09		Dec-09		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	
17 alpha-Ethinyl-Estradiol	U	1.28	U	1.20	U	0.708	1.52 (K)	0.367	U	0.719	U	0.977	U	0.563	1.49 (K)	0.69	2.27 (K)	0.889	U	2.56	U	1.77	U	1.26	U	2.36	U	1.96	Ovulation inhibitor
17 beta-Estradiol	U	0.831	U	0.463	U	0.350	0.692 (K)	0.412	U	0.476	U	0.336	U	0.434	0.767 (K)	0.263	0.827 (K)	0.735	U	1.61	U	1.14	1.31 (K)	0.557	U	1.69	U	1.20	Sex Hormone
Androstenedione	U	24.0	U	14.2	9.04 (K)	6.43	U	9.41	U	14.4	U	14.5	U	12.9	U	5.64	U	12.0	U	10.6	U	7.12	U	10.0	U	10.9	U	15.8	Anabolic agent
Androsterone	U	0.132	U	0.0934	U	0.447	U	0.129	U	0.154	U	0.115	U	0.265	U	0.089	0.167 (K)	0.0983	U	0.104	U	0.0956	U	0.127	U	0.150	U	0.145	Hormone metabolite
beta-Sitosterol	316	3.30	186	0.904	5280	0.897	172	2.47	97.4	1.77	223	1.46	201	0.807	86	2.12	232	3.54	140	4.39	462	0.736	U	2.60	9.00	3.65	88.0	0.89	Plant sterol
beta-Stigmastanol	27.7	5.95	3.61	0.987	34.7	0.674	4.00	2.21	U	3.92	3.76	1.33	1.09	0.599	U	2.07	22.4	2.63	11.3 (K)	5.16	4.49	0.684	U	2.66	U	4.28	3.35 (K)	0.983	Plant sterol
Campesterol	42.5	6.27	6.30	2.07	61.0	3.44	6.40	3.27	U	3.52	3.62	2.63	U	3.66	U	2.81	23.9	4.94	U	14.2	U	3.72	U	3.58	U	14.2	U	6.48	Plant sterol
Cholestanol	13.5	2.48	3.62	0.717	10.8	1.96	5.71	2.06	U	1.37	U	0.705	U	1.37	U	1.49	79.8	2.04	2.67	1.99	1.14	0.57	U	2.39	U	1.13	U	1.72	Sterol
Cholesterol	206	9.35	U	3.27	U	3.97	29.5	3.97	U	4.02	U	3.54	U	4.34	U	3.24	4060	8.18	U	19.1	U	4.41	U	4.84	81.0	15.5	U	6.87	Sterol
Coprostanol	10.6 (K)	6.31	4.45	1.34	5.13	2.43	U	2.44	U	2.47	2.31	2.06	U	2.45	U	2.06	17.2	5.56	U	17.0	U	2.43	U	3.08	U	11.5	8.60	6.32	Sterol
Desmosterol	40.1 (K)	12.9	7.79	3.83	13.6	6.27	U	10.4	U	4.86	U	4.46	U	5.29	U	7.26	22.8	8.60	U	22.6	U	5.02	U	11.3	U	20.8	U	11.5	Sterol
Desogestrel	U	0.872	1.34	0.542	U	0.483	U	0.532	U	0.445	0.806	0.469	U	0.456	U	0.377	U	0.458	U	0.419	U	0.443	U	0.372	U	0.508	0.972	0.669	Ovulation inhibitor
Epicoprostanol	U	6.99	U	1.5	U	2.7	U	2.59	U	2.74	U	2.30	U	2.72	U	2.18	U	6.11	U	19.1	U	2.70	U	3.26	U	13.0	8.74 (K)	7.11	Sterol
Equilin	U	2.56	U	2.55	U	1.38	U	1.69	U	1.62	U	1.80	U	1.74	U	1.03	4.90 (K)	2.57	U	6.43	U	4.92	U	2.55	U	5.53	U	4.46	Hormone replacement
Ergosterol	53.5	6.63	3.32	1.55	U	3.41	U	3.85	U	3.80	U	1.43	U	4.31	U	4.03	U	4.04	U	7.18	U	2.53	U	5.20	U	6.52	U	3.11	Sterol
Estriol	U	2.35	U	2.19	U	1.12	U	1.92	U	1.72	U	2.03	U	0.866	U	1.48	U	0.543	U	1.03	0.425 (K)	0.18	U	1.03	U	1.31	U	1.93	Sex Hormone
Stigmasterol	174 (N)	4.09	28.5	2.00	1150 (N)	1.19	57.0	3.93	31.4 (N)	1.46	44.9	2.01	51.8 (N)	0.971	28.0	3.31	50.9	4.82	U	5.78	114 (N)	1.30	U	3.37	U	5.34	23.6	1.30	Plant sterol
Testosterone	U	11.8	U	5.01	U	3.55	U	7.04	6.29 (K)	5.16	U	5.09	U	3.96	8.29	4.66	14.4	5.03	U	5.22	U	3.86	23.3	10.7	U	4.19	U	11.9	Sex Hormone

* Analysis for the sample collected in December 2009 at WTPEP01 was repeated in triplicate due to the complex nature of the matrix. The results reported above as WTPEP01 Dup1 and WTPEP01 Dup 2.

DL = Detection Level

K = Peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration

N = Percent Recovery was slightly above nominal method upper control limit

NQ = Not Quantifiable

U = Not Detected.

**Table 5c. Blank Corrected Results for
AXYS Method MLA-075 (EPA Method 1694) Detected Substances at SWRP Monitoring Locations (ng/L)**

Substance	TP2.3								TP2.7								Classification
	Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	
1,7-Dimethylxanthine (p-Xanthine)	26100	942	30900	1590	42000	1870	40500	543	U	169	U	172	832	450	204	122	Antispasmodic, caffeine metabolite
2-Hydroxy-ibuprofen	85600 (N)	947	67200	5730	88600 (N)	244	24800	139	U	89.9	U	91.6	1190 (N)	240	U	162	Anti-inflammatory
4-Epianhydrotetracycline (EATC)	74.1	62.8	250	238	U	70.3	U	25.9	86.4	26.3	130	55.9	U	61.1	U	30.4	Chlorotetracycline degradate
4-Epioxytetracycline (EOTC)	U	23.7	U	33.6	U	18.2	U	10.4	U	8.36	U	13.8	U	18.0	U	12.2	Oxytetracycline degradate
4-Epitetracycline [ETC]	24.3	23.7	U	22.6	10.2	7.83	U	13.8	U	7.16	U	7.49	U	18	U	12.2	Tetracycline degradate
Acetaminophen	149000	3400	202000	2090	209000	2650	114000	250	U	67.4	U	68.7	U	180	U	30.4	Antipyretic, Analgesic
Albuterol	20.0	1.18	18.2	2.13	28.2	0.332	11.3	0.585	10.9	0.326	8.64	0.356	18.9	1.19	11.7	0.605	Antiasthmatic
Amphetamine	672	5.88	609	14.5	1650	6.76	812	10.1	33.6	1.63	23.7	2.15	22.7	5.96	23.7	3.03	Stimulant
Atenolol	1590	2.35	1990	11.6	2050	3.09	1960	3.21	752	0.651	688	1.56	1310	2.40	819	2.37	Antihypertensive
Atorvastatin	65.2	34.2	65.0	19.7	17.4	15.0	41.2	2.93	U	9.64	U	6.36	U	59.6	U	3.03	Lowers blood cholesterol
Azithromycin	744	5.92	268	5.64	289	4.29	179	8.74	713	1.69	1030	1.72	181	4.50	353	9.27	Macrolide Antibiotic
Bisphenol A	U	29600	U	9410	U	7620	1640	863	U	2810	U	2860	U	7510	U	1010	Used to make plastics
Caffeine	70300	59.2	90300	56.4	105000	210	73100	25.9	U	16.9	18.3	17.2	323	45.0	U	30.4	Stimulant
Carbamazepine	955	5.92	768	5.64	731	1.52	903	2.59	709	1.69	635	1.72	646	4.50	620	3.04	Anticonvulsant
Cimetidine	579	1.18	546	1.07	582	0.880	550	8.91	3.13	0.326	0.533	0.356	U	2.39	U	1.21	Anti-acid reflux
Ciprofloxacin	292	23.7	475	22.6	262	36.1	174 (N)	14.6	103	8.19	89.5	8.50	145	18.0	41.5 (N)	23.3	Quinoline antibiotic
Clarithromycin	140	5.92	25.2	5.64	574	1.52	U	2.59	45.9	1.69	90.6	1.72	324	4.50	36.0	3.04	Macrolide antibiotic
Codeine	282	11.8	237	45.8	265	3.00	250	5.85	U	48.1	U	31.1	69.0	11.9	13.2	6.05	Opiate
Cotinine	2890	5.88	2590	37	3090	1.50	3570	2.93	70.0	1.75	25.3	1.78	28.8	5.96	28.8	5.33	Nicotine metabolite
Dehydronifedipine	5.67	2.45	10.6	2.26	3.37	0.610	6.41	1.6	3.11	0.674	4.40	0.687	5.71	1.80	8.64	1.22	Nifedipine metabolite

DL = Detection Level
K = Peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration
N = Percent Recovery was slightly above nominal method upper control limit
NQ = Not Quantifiable
U = Not Detected

**Table 5c. Blank Corrected Results for
AXYS Method MLA-075 (EPA Method 1694) Detected Substances at SWRP Monitoring Locations (ng/L) (continued)**

Substance	TP2.3								TP2.7								Classification
	Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	
Digoxin	U	59.2	U	56.4	U	15.2	36.6	17.1	U	16.9	U	17.2	U	45.0	U	12.2	Cardiac glycoside
Diltiazem	310	1.30	325	3.07	394	0.746	449	1.92	57.4	0.337	34.7	0.344	123	0.901	54.8	0.609	Antihypertensive
Diphenhydramine	267	2.37	1250	4.87	549	0.610	888	1.04	264	0.803	463	0.687	376	1.80	72.4	1.22	Antihistamine
Doxycycline	39.7	23.7	73.8	23.2	27.1	15.0	U	10.4	U	6.74	U	11.1	27.4	20.7	U	12.5	Tetracycline antibiotic
Enalapril	16.5	1.18	18.1	1.47	172	0.300	17.1	0.585	U	0.430	U	0.405	U	1.19	U	0.605	Treats hypertension
Erythromycin anhydrate	311	1.18	363	5.72	298	0.305	252	0.518	239	0.337	270	0.344	226	0.901	191	0.609	Macrolide antibiotic
Fluoxetine	9.52	5.92	38.4	5.64	20.2	2.84	18.4	2.59	26.4	1.69	28.8	1.72	38.6	4.50	29.6	3.04	SSRI Antidepressant
Furosemide	725	166	1070	464	1540	129	1640	87.1	259	134	508	183	838	146	441	125	Diuretic
Gemfibrozil	4060	17.7	4810	9.28	5890	11.8	24.1	8.38	94.2	1.69	27.5	1.72	590	4.50	110	3.04	Antilipemic
Glipizide	U	71	25.8	22.6	42.9	18.3	25.5	10.4	11.8	6.74	U	6.87	U	18.0	U	12.2	Glucose control
Glyburide	U	35.5	30.0	11.3	29.6	9.15	446	5.18	17.2	3.37	18.9	3.44	9.49	9.01	19.4	6.09	Glucose control
Hydrochlorothiazide	1240	237	904	75.2	756	61.0	80100	34.5	667	22.5	708	22.9	927	60.1	393	40.6	diuretic
Hydrocodone	U	66	110	10.6	78.2	2.15	112	2.93	85.2	1.63	76.2	1.78	65.2	5.96	67.8	3.03	Narcotic pain reliever
Ibuprofen	35300	177	23600	84.1	31900	46.4	12400	84	48.7	16.9	38.6	17.2	194	45.0	78.8	30.4	Analgesic
Lincomycin	51.3	27.6	41.2	26.4	57.3	14.6	21.1	9.46	U	7.87	U	8.02	U	21.0	7.21	6.09	Lincosamide antibiotic
Metformin	62300	741	166000	722	NQ	NQ	85900	543	9800	646	10300	787	5080	235	3740	34.2	Anti-diabetic drug
Miconazole	27.6	6.35	44.5	5.64	9.11	3.94	U	8.87	1.78	1.69	U	1.72	U	4.50	U	3.04	Antifungal agent
Naproxen	19000	35.5	13600	15	15200	9.15	194	5.18	284	7.51	67.6	3.62	198	10.7	91.1	6.09	Non-steroidal anti-inflammatory drug
Ofloxacin	U	59.2	U	56.4	23.1	15.2	6.11 (N)	2.59	U	16.9	U	17.2	U	45.0	4.60 (N)	3.04	Quinoline antibiotic
Oxycodone	204	3.64	174	2.13	222	1.92	296	1.17	147	0.651	104	14.9	157	4.61	160	15.5	Narcotic pain reliever

DL = Detection Level

K = Peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration

N = Percent Recovery was slightly above nominal method upper control limit

NQ = Not Quantifiable

U = Not Detected

**Table 5c. Blank Corrected Results for
AXYS Method MLA-075 (EPA Method 1694) Detected Substances at SWRP Monitoring Locations (ng/L) (continued)**

Substance	TP2.3								TP2.7								Classification
	Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	
Penicillin G	U	4.73	U	4.51	U	1.22	U	6.17	1.79	1.35	U	1.37	U	3.60	U	6.09	β-lactam antibiotics
Penicillin V	40.8	11.8	U	11.3	68.1	13.5	U	13.9	U	3.37	U	3.44	U	30.0	U	6.09	β-lactam antibiotics
Ranitidine	1620	8.78	2700	7.16	792	5.53	871	5.32	16.0	1.01	4.94	1.08	25.8	2.47	5.68	1.21	Anti-acid reflux
Sulfadiazine	30.0	5.92	43.3	5.64	106	2.61	U	2.59	8.75	1.69	17.2	1.72	10.1	4.50	U	3.04	Sulfonamide antibiotic
Sulfadimethoxine	U	1.18	U	1.13	U	7.34	26.4	1.85	U	0.337	U	0.344	U	0.901	U	0.629	Sulfonamide antibiotic
Sulfamerazine	11.1	5.06	U	3.15	U	3.82	U	1.04	U	0.900	U	1.47	U	5.33	U	1.22	Sulfonamide antibiotic
Sulfamethazine	U	2.37	10.3	9.29	U	19	U	1.85	U	0.674	3.44	2.69	U	1.8	7.63	2.93	Sulfonamide antibiotic
Sulfamethizole	U	4.18	U	4.06	7.11	5.50	U	6.46	U	0.674	U	1.04	U	5.01	U	6.33	Sulfonamide antibiotic
Sulfamethoxazole	2170	5.29	1890	9.55	2050	13.4	2070	5.25	607	1.26	475	0.687	585	7.02	829	3.42	Sulfonamide antibiotic
Sulfanilamide	U	59.2	U	56.4	U	15.2	U	25.9	27.7	16.9	30.7	17.2	U	45.0	71.4	30.4	Sulfonamide antibiotic
Tetracycline (TC)	55.6	23.7	46.6	22.6	13.8	6.46	U	13.6	U	6.74	U	7.35	U	18.0	U	12.2	Tetracycline antibiotic
Thiabendazole	14.1	5.92	29.2	5.64	24.5	1.63	19.0	5.52	14.1	1.69	23.0	1.72	21.1	4.50	21.7	3.04	Fungicide and parasiticide
Triamterene	172	1.79	512	7.19	401	0.644	264	1.07	223	0.326	357	0.427	371	1.19	302	0.605	Diuretic
Triclocarbon	741	35.5	1080	11.3	202	9.15	1740	7.67	19.1	3.37	34.6	3.44	28.4	9.01	89.8	6.09	Antimicrobial, disinfectant
Triclosan	2430	710	3910	226	1630	183	6.42	2.76	U	67.4	U	68.7	U	180	U	122	Antimicrobial, disinfectant
Trimethoprim	470	31.1	623	10.3	579	4.31	601	4.27	38.7	5.80	26.2	3.09	364	4.50	109	3.04	Pyrimidine antibiotic
Virginiamycin	U	127	1050	441	U	21.1	U	32.1	U	37.2	U	68.4	U	12.1	U	6.09	Macrolide antibiotic
Warfarin	U	17.7	U	5.64	4.99	4.57	U	2.59	U	1.69	U	1.72	U	4.50	U	3.04	Anticoagulant

DL = Detection Level

K = Peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration

N = Percent Recovery was slightly above nominal method upper control limit

NQ = Not Quantifiable

U = Not Detected

**Table 5d. Blank Corrected Results for
AXYS Method MLA-068 (EPA Method 1698) Detected Analytes at SWRP Monitoring Locations (ng/L)**

Substance	TP2.3								TP2.7								Classification
	Sep-09		Dec-09		Mar-10		Jun-10		Sep-09		Dec-09		Mar-10		Jun-10		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	
17a-Dihydroequilin	U	6.76	U	42.9	U	28.1	U	13.7	U	5.23	48.9	17.0	U	8.24	U	5.14	Sterol
17 alpha-Estradiol	U	11.0	34.1	24.4	149	60.9	40	15.0	U	1.31	U	2.44	U	2.69	U	1.44	Sex Hormone
17 alpha-Ethinyl-Estradiol	10.7 (K)	5.68	U	14.9	U	8.74	U	7.28	U	1.31	U	3.94	U	2.11	U	0.776	Ovulation inhibitor
17 beta-Estradiol	12.5 (K)	8.93	37.7 (K)	19.2	U	47.9	U	11.7	U	1.15	U	2.09	U	2.12	U	1.04	Sex Hormone
Androstenedione	236	108	U	435	U	593	U	73.7	U	20.6	U	49.2	U	39.6	U	18.3	Hormone metabolite
Androsterone	1450	0.765	1530	14.9	NQ	NQ	677	3.67	U	0.325	U	0.589	U	0.436	U	0.336	Hormone metabolite
beta-Sitosterol	9270	23.5	3350	1990	9570	10.5	4950	13.0	861	2.68	169	1.91	17600	67.5	5050	41.9	Plant sterol
beta-Stigmastanol	948	13.8	133	124	1450	15.9	610	50.4	173	7.92	15.1	1.38	260	60.0	U	70.2	Plant sterol
Campesterol	4240 (K)	59.6	836	50.6	2480	11.9	1360	114	198	5.70	18.1	2.19	426	112	U	109	Plant sterol
Cholestanol	2310	18.7	451	49.7	1780	12.7	911	95.7	415	2.49	36.2	0.884	101 (K)	18.5	U	83.7	Sterol
Cholesterol	101000	86.7	18100	1990	36900	43.2	28500	122	3850	10.2	331	4.03	371	124	280	129	Sterol
Coprostanol	63500	51.6	1180	124	28600	20.1	17900	61.4	3820	6.48	236	2.10	178 (K)	73.1	168 (K)	40.2	Sterol
Desmosterol	583 (K)	279	U	353	1450	334	U	591	73.9 (K)	13.2	22.8	6.55	U	355	U	361	Sterol
Desogestrel	U	1.56	U	14.9	U	87.3	66.8 (K)	8.58	U	2.81	4.29	2.32	U	2.77	U	4.11	Ovulation inhibitor
Epicoprostanol	3890	48.8	U	124	359	17.0	334	65.1	140	7.19	10.3	2.35	U	84.8	U	42.6	Sterol
Equilenin	15.92	10.6	U	36.3	U	NQ	U	23.0	U	2.69	U	7.53	U	12.6	U	3.39	Hormone replacement
Ergosterol	U	84.6	U	124	183	10.8	U	165	283	10.8	33.1	3.10	U	163	U	186	Sterol
Estriol	737	17.6	359	64.2	NQ	NQ	145	10.7	U	2.85	U	7.80	U	2.72	U	2.55	Sex Hormone
Estrone	70.8 (K)	29.1	153 (K)	116	U	159	U	87.3	8.30 (K)	5.08	U	12.3	26.6	7.89	7.15 (K)	3.45	Sex Hormone
Mestranol	18.3	16.6	U	25.9	NQ	NQ	U	29.8	U	2.63	16.6	14.1	U	8.03	U	3.93	Ovulation inhibitor
Norethindrone	2960 (K)	1020	U	265	NQ	NQ	956 (K)	147	U	4.13	U	13.5	U	12.9	48.2	22.2	Ovulation inhibitor
Norgestrel	2065 (K)	204	408	390	U	44.1	U	73.1	U	11.0	U	28.6	U	13.4	U	13.8	Ovulation inhibitor
Progesterone	348 (K)	167	852 (K)	473	U	134	56.3 (K)	52.0	U	12.6	U	38.1	U	16.8	U	7.71	Sex Hormone
Stigmasterol	2170	53.0	974	49.7	2270 (N)	3.87	1150	50.1	306 (N)	5.22	56.6	2.75	4740	101	270	121	Plant sterol
Testosterone	1370	125	1080	224	NQ	NQ	2230	233	U	13.0	U	28.9	U	22.0	U	20.5	Sex Hormone

DL = Detection Level

K = Peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration

N = Percent Recovery was slightly above nominal method upper control limit

NQ = Not Quantifiable

U = Not Detected